Thirty years of induction and integration of useful mutants in rice genetics and breeding

In 1976 an induced semidwarf was directly released in California as the cultivar Calrose 76, the first semidwarf table rice cultivar in the US. The sd1 gene in this cultivar is allelic to the sd1 source in the Green Revolution cultivars of the tropics. The main value of Calrose 76 has been its use as a semidwarf donor in conventional cross-breeding programs. Thus it has served as the ancestral source of semidwarfs in numerous improved cultivars developed by breeders in California, Australia and Egypt. The semidwarfs convey much-needed lodging resistance and responsiveness to fertilization, resulting in 15-20% yield increases at the farm level. At the same time the semidwarf mutant was induced, mutants also were found for early maturity, one of which was used in cross-breeding to develop the semidwarf, early maturing cultivar M-101. Following the initial success with semidwarfism and early maturity, other applications were sought for induced and spontaneous mutants. In the late 1970s and 1980s in California these included endosperm mutants and an elongated uppermost internode (eui) mutant for potential used in hybrid seed production. In the 1990s induced mutants were sought in Arkansas, To date these have included 11 semidwarfs, all nonallelic to sd1. Although phenotypically similar to sd1, these nonallelic mutants have not shown the increased yield capability of sd1. Other mutants found in Arkansas have included early maturity mutants, an eui mutant in indica germplasm, a low phytic acid mutant, and a putative giant embryo mutant. Also, semidwarf and early maturing mutants have been intercrossed to develop semidwarf, early maturing basmati germplasm. An exciting current application is induction of early maturing mutants in high yielding indica germplasm, thus offering the potential for use of indica, i.e., tropical rice, in the US, which to date has been a japonica rice growing nation.